Managing Complexity in Implementing ERP Projects

Urwin, G

ACIS 2001 PAPER SUBMISSION COVER-PAGE

Paper Title:	**Managing Complexity in Implementing ERP Projects**		
Author Name(s):	**Gerry Urwin**		
Contact Author: Email address: Fax: Phone:	**Gerry Urwin** **G.Urwin@coventry.ac.uk** **44 24 7688 8400** **44 24 7688 8434**		
Paper Category (circle one):	Research Paper	xxx Research in Progress xxxx	Case
Prior Publication (delete not applicable):	The paper has NOT been presented or published elsewhere		

AUTHOR DECLARATION

By submitting this paper to ACIS 2001 the author(s) warrant that:

- they are the copyright holders in the paper;
- the paper is accurate in all factual respects;
- the contents have been cleared for publication by any organisation having the capacity to preclude their publication;
- the approval has been secured of the copyright owner of any material which has been previously published.
- they accept full responsibility for statements made both in written papers and in presentations;
- they undertake that at least one of the authors will register for the, will present the paper, and will be available to answer questions and discuss the paper with other delegates;

(Please leave blank, reviewer use only)

Managing Complexity in Implementing ERP Projects

Gerry Urwin

DBA Associate
Henley Management College,
Henley on Thames
United Kingdom
Phone +44 121 354 4186
Fax +44 2476 888400
G.Urwin@Coventry.ac.uk

Research in Progress:

Keywords:

IS Project Management; Complexity; ERP

Abstract

Many IS projects still fail, fall short of their objectives or have difficulty in justifying their investment through improved performance. This paper focuses on Enterprise Resource Planning (ERP) systems implementations which, it is argued, are inherently complex, and when taken together with contextual influences can create novel combinations of variables, which challenge established project management prescriptions.

This research takes a case study approach, exploring contradictory findings to help build a more developed understanding of how project management effectiveness is influenced by project complexity in determining the degree of success in ERP projects.

Introduction

Many IS projects still fail, fall short of their objectives or have difficulty in justifying the investment through improved performance (Pinto, 1997; Whyte, & Edwards, 1997; Remenyi, 1999). The Standish Group CHAOS research programme (Johnson, 2000) indicates a consistently low success rate for projects of below 30% from 1994 - 2000, with the rest of the projects being classified as either failed or 'challenged' (i.e. the project is completed over time, over budget and/ or with fewer features and functions than expected). Yet the amount of excellent literature on how to better manage projects continues to grow. This paper, while still reflecting research in progress, aims to offer some tentative explanations of this paradox.

The paper briefly summarises the literature, developing a first cut conceptual framework, which synthesises variables from the literature and how they relate to the key actors in information systems implementation. The importance of complexity is explained, and defined in relation to this research. The research methodology is summarised, and initial themes that have been identified are tabled, together with some tentative conclusions. This research is still 'work in progress' and therefore any conclusions are still tentative.

Literature

The interdisciplinary nature of information system (IS) projects, means that research can be found in such varied disciplines and sub - disciplines as, information systems, project management, strategic management, human resource management, organizational behaviour, organizational communication and business process re-

engineering, among others. Much information systems research has been carried out from a largely positivist perspective, often in a reductionist manner, and evidence in the literature suggests that significant knowledge has been gained about individual, and groups of variables which influence the degrees of success of information systems projects (Galliers & Baker, 1994; Earl, 1996; Dvorak et al., 1997; Ives & Javenpaa, 1991; Morris, 1996). However, (Morris, 1996:324), after gathering data on over 3500 projects, found that,

> "*project management had set itself a task - to bring a project in, on time, in budget, to technical specification - yet all the evidence showed that projects appeared consistently to fail in this objective"*

He identified that the most common negative influences on projects were external and strategic factors, which at the time were rarely addressed by project management. However, the ninety factors that (Morris & Hough, 1987) identified as influencing project success, together with manuals, checklists and guidelines such as the PMI Project Management Body of Knowledge (PMBoK) and PRINCE2, are excellent examples of the development of knowledge concerning project managers required attributes, and the project management process. Yet, as detailed earlier, projects continue to fail or be 'challenged' at a disturbing rate.

It could be argued, of course, that as knowledge of project management developed, so too did the expectation of what information systems could deliver to an organization. In the last decade there has been a clear increase in coverage of information systems across the value system (Porter, 1985), or supply chain; from function based systems such as financial ledgers and material requirements planning (MRP), through integrated suites of application programs, to Enterprise Resource Planning, electronic data interchange (EDI), internet based customer relationship management (CRM) and enterprise application integration (EAI). All of this development has increased the level of difficulty in implementing information systems across a broader, more diverse user base.

It is well documented and generally accepted that the management of significant organizational change is a difficult process (Wilson, 1992), and in the case of ERP information systems implementation, the diversity and interdependence of the elements that go to make up technological, organizational and potentially behavioural change, causes a degree of complexity that is rarely made explicit. The project manager must manage this complexity, while operating as the central hub of the human communications network that exists between the main actors in the project, client management, users, consultants and vendors. The conceptual framework illustrated in Figure 1. synthesises many of the variables identified in the literature, in order to demonstrate this complexity. This was a first stage conceptual framework in developing the research design. Variables can be both situational or contextual, and project management based, also variables may figure more than once, e.g. politics may be important between users and managers, and the project manager and business managers.

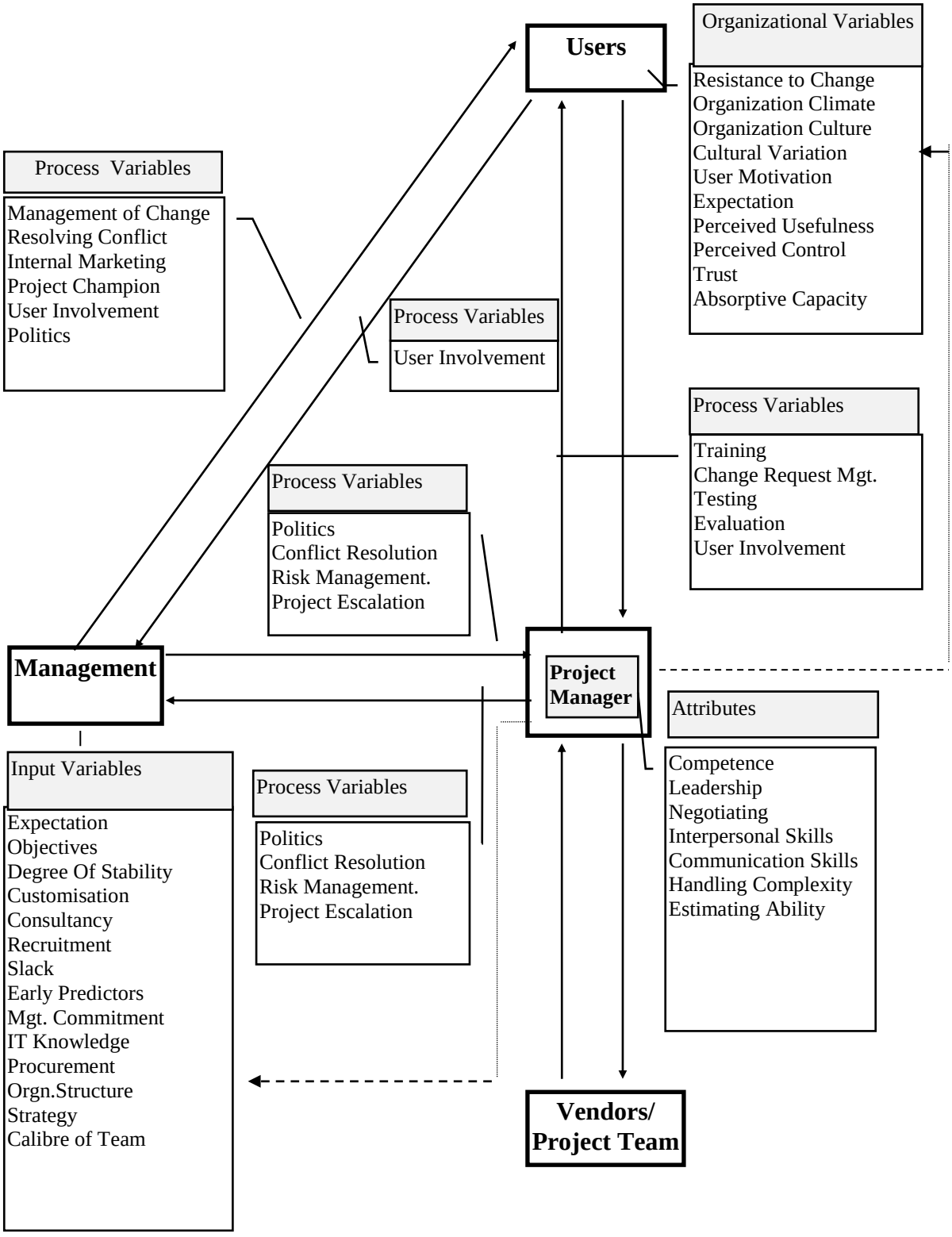
ERP systems were chosen as a focus for this research because initially it was necessary to reduce the scope of such a large set of literatures, but importantly they were felt to illustrate the degree of complexity which appears to have become commonplace for information systems implementation.

Complexity

The implementation of ERP systems is complex. Up to this point there has been an acceptance of the general use of the term 'complexity'. It is useful at this stage to be more explicit. (Huber & Daft, 1987) identify three components of complexity as a characteristic of an environment; numerosity, diversity and interdependence. This can be applied usefully in the implementation of such information systems. Numerosity is evidenced because, of their nature, ERP systems create access to more information flows across previous functional boundaries, encourage processes which redefine organizational limits and facilitate decision making through the use of a single set of integrated data. In short, increasing numbers of people use the system for a greater variety of purposes.

Diversity is also apparent when one looks at the cross functional approach adopted in ERP systems. For example, (Bancroft et al., 1998) argues that SAP R/3 is one of the most complex software application packages ever written, seeking to support all aspects of business operations, and as the market leader in

Figure 1. A Synthesis of Project Management and Contextual Variables from the Literature


Users
Organizational Variables
Resistance to Change
Organization Climate
Organization Culture
Cultural Variation
User Motivation
Expectation
Perceived Usefulness
Perceived Control
Trust
Absorptive Capacity
Process Variables
Management of Change
Resolving Conflict
Internal Marketing
Project Champion
User Involvement
Politics
Process Variables
User Involvement
Process Variables
Training
Change Request Mgt.
Testing
Evaluation
User Involvement
Process Variables
Politics
Conflict Resolution
Risk Management.
Project Escalation
Management
Project Manager
Attributes
Competence
Leadership
Negotiating
Interpersonal Skills
Communication Skills
Handling Complexity
Estimating Ability
Input Variables
Expectation
Objectives
Degree Of Stability
Customisation
Consultancy
Recruitment
Slack
Early Predictors
Mgt. Commitment
IT Knowledge
Procurement
Orgn.Structure
Strategy
Calibre of Team
Process Variables
Politics
Conflict Resolution
Risk Management.
Project Escalation
Vendors/
Project Team

ERP systems, this obviously sets the standard to which others aspire. This is also reflected in the multi-disciplinary nature of the literature related to information systems implementation.

(Mason & Mitroff, 1981) identify the key factor of complexity as being the interdependence between elements. This is echoed by (Huber & Daft, 1987)'s emphasis on diversity and interdependence. It is this interdependence which was a focus of this research, as it attempts to develop understanding of the unpredictable nature of information systems implementation, and how project managers can better respond to this unpredictability. Thus, while the initial stages of complexity, numerosity and diversity can be managed through planning and control methods, project management software, and procedural rigour, it is argued that the interdependent nature of the large number of project, and contextual variables can create novel conditions which can challenge expectations, and demand a level of flexibility and adaptation which challenges what can otherwise be described as well managed projects.

Methodology

The aims of this research are twofold:

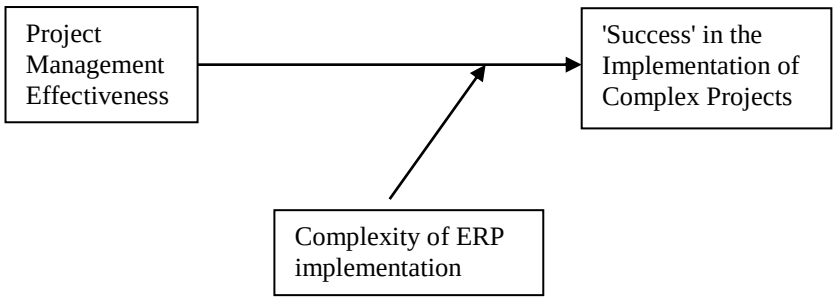
1. To identify project management lessons from the implementation of complex information systems projects.
2. To sharpen understanding of the implementation of complex information systems projects.

The case study method was adopted as an appropriate form of data gathering because of the nature of the research in posing "how" and "why" type questions (Yin, 1994; Eisenhardt, 1989), and as is illustrated below, it allowed access to a greater degree of rich data on issues arising in the project management process.

The conceptual model illustrated in Figure 2. summarises the key elements of the research. Project management effectiveness was assessed against criteria which evolved from the first cut conceptual framework, and were piloted through interviews with senior IS managers and project managers. This became a screening questionnaire, used in conjunction with semi-structured interviews which were used, together with supporting documentation, to develop case studies.

Success was defined in the context of the project, using criteria from (DeLone & McLean, 1992). Complexity was also defined in the context of the case study incorporating the number, diversity and inter-relatedness of the contextual variables.

Figure 2. Conceptual Model



The following proposition was made:

'Success' is moderated by the complexity of the ERP implementation, i.e. the more complex the implementation, the more effective the project management needs to be, or the higher the risk to a successful project outcome

The study population for the purposes of this research was defined as: implementations of complex information systems projects (ERP) projects. Three in-depth case studies were conducted, with nine further case studies to provide greater substantiation. The objective was to develop an understanding of the variables in an applied setting, using both within case, and cross case analysis.

Confirming and disconfirming sampling (Kuzel, 1992) was carried out, incorporating snowball or chain sampling. One of the frequent difficulties in gaining access in such research is finding respondents who are prepared to be associated with, or speak about projects which can be seen as less than successful. In order to overcome this problem cases were selected through existing contacts, personal recommendations, and indirect recommendations. Experience in some of the early exploratory interviews had suggested that once the researcher gained the trust of the respondents, often through being perceived as an 'insider', with a common background in project management and information systems management to many of the interviewees, there were few problems in exploring any of the aspects of unsuccessful projects. It is for this reason that this particular form of sampling was most appropriate.

There were two noticeable features of this form of gaining access which supported the validity of the data. The first was that, in a number of the cases as the interview progressed, and as the level of disclosure increased, there was a marked increase in the desire for anonymity for both the respondent and the organization for which they worked. The second point of note was that on a number of occasions the completed screening questionnaire was very misleading, in that the project was clearly identified as successful against most criteria, and yet once involved in the interview, the respondent either changed their mind as to their initial response, or they identified significant problems within the project, which were subsequently resolved, or diminished in importance in relation to the final project completion. These would not have been apparent through the use of questionnaires alone.

The case study profiles are shown in Table 1. below.

Table 1. Case Study Profiles

Case	**Type**	**Software**	**Region/ Country**	**No. of Countries Implemented**	**Respondent**
Case 1	ERP	IMPACT	South Africa	1	Consultant IT Manager
Case 2	ERP	JBA	Europe	6	IT Manager
Case 3.	ERP	JD Edwards	Europe	6	IT Director IT Manager 'Superuser'
Case 4.	ERP	SAP	Global		ERP Director IT Strategy Mgr. 'Superuser'
Case 5.	ERP	Oracle	Global	13	Commercial Director Project Manager
Case 6.	ERP	TIS	Europe	13	IT Director Bus. Systems Manager
Case 7.	ERP	SAP	Global	7	IS Director 'Superuser'
Case 8.	EAI	Anon.	Global	6	UK IS Manager
Case 9	ERP	JBA	UK	1	IT Manager Consultant
Case 10	ERP	Baan	UK	1	Managing Consultant
Case 11.	ERP	SAP	Europe	13	IT Director Project Manager
Case 12.	ERP	Bestmate Commerce	Europe	5	Consultant

One of the findings of the data gathering process was that the whole idea of measuring success was highlighted as a very difficult, if not impossible task. Perceptions of success sometimes varied very significantly, between the questionnaire and the interview for the same respondent, between respondents, and over time. For example, the IS director in one of the cases surveyed a large number of users 3 months after 'go live' date, and received a clear negative reaction. Now, 12 months later, the reaction is very positive.

Preliminary Results

Themes which have been identified thus far in the research include:

Theme	Description
1.Organizational Culture	While culture figures quite commonly in the literature of the management of change, it was surprising the frequency and strength of response as to the influence of different cultural expectations on the process of managing the project. The influence of culture operated at the departmental, site, business unit, and 'company'
2.National Culture	Very distinctive differences in managerial style were identified between European countries especially e.g. France, Netherlands, Germany, Sweden, UK. In some instances the project was actively managed differently to accommodate this, in others there was a resolve to do so 'next time'.
3.Technical Knowledge	An important factor was identified as ERP product knowledge, but at two levels, an awareness of what the product did, and an ability to advise clients on how best to change processes to take advantage of what the product could do. Shortage of skill in both these areas can affect the implementation.
4.Business Knowledge	This is especially a problem with external consultants, who may have technical or product knowledge but lack the detailed organizational knowledge to apply it effectively.
5.Staff Turnover	Related to the need for technical and business knowledge, is the need for stability of resources. Changes to key personnel had a significant impact in several cases.
6.Environmental Change	Issues which affect the project, but which are outside the project manager's control. The most frequent and serious of these are organizational restructuring, either centralisation/ decentralisation, or merger and acquisition.
7.Post Implementation Change Initiative	There was seen to be a need for a two stage approach, the first to implement an operational, and operating system, the second to proactively look at leveraging the new system to improve processes. The reason for the two stages is related to the lead time of projects and the likelihood of environmental change, which in turn changes the desirability and feasibility of original objectives. These factors lead to a desire to "get it in and working", but with a certain loss of momentum once accomplished.
8.Learning through Experience	There was almost unanimity in seeing the projects as a learning process, some reflecting that it is only through experiencing some of the problems that their importance is appreciated. This appears to be a critical theme, which needs to be explored in more depth.
9.Communication	Virtual unanimity in stressing the importance of communication in all stages of the project. These include difficulties of persuading stakeholders of issues learnt through experience. Again this theme needs to be explored in more depth.
10.The "Mythical User"	The misleading nature of grouping disparate bodies of employees. The literature often refers to 'the user (s)' as if they were an homogenous body. In complex organizations they are not. Often requires a "niche strategy" in such areas as communication, training, and testing.
11.Clarity and Agreement of Objectives	Objectives are often obscured by political processes. Objectives should be known, clear and agreed by all relevant stakeholders. Proactive pursuit of 'buy-in' needed. This theme could be explored further in terms of 'who' needs to agree. There were a number of top down implementations where very direct leadership was given.

12.Appropriate Senior Project Sponsor	In what is perceived as a high risk process, the perceived importance of the implementation to the future of the business is associated with who is the sponsor. Not a new finding, but strongly supported nonetheless.
13.Flexibility	The ultimate paradox, how to achieve flexibility, without losing control. This especially relates to the size and frequency of environmental change, which in turn may affect objectives, resources or scope. In addition the ability to adapt to often difficult challenges, with very little contingency, or slack in terms of resources.
14.Follow the 'Spirit Rather than the Letter' of Project Management	In a dynamic and complex implementation, highly structured project planning and control methods may ultimately work against the project, diverting time and resources. Flexibility may also relate to methods, or emphasis on methods used.

Conclusion

The review of the literature demonstrated that a wide variety of prescriptions have been proposed, and that an impressive array of variables are suggested as having an influence on the success in implementing information systems. However, despite all this research significant number of projects continue to fail (Pinto, 1997; Davenport et al., 1992), or do not achieve their potential (Johnson, 2000).

Therefore, it is suggested that some or all of these variables may be necessary, but not sufficient to successfully implement such systems. Prescriptions should be treated cautiously, because the complexity inherent in implementing large scale information systems will cause novel and unpredictable outcomes from ostensibly similar events, organizations or projects.

At this early stage in the analysis of the data these themes are clearly evident. While the need for a senior management project sponsor is not new, other areas such as the need for flexibility seem to support the contention that the complexity caused through inter-related variables can create novel or unexpected situations, which require some adaptation on the part of the project management. These themes also reflect the combination of project management and contextual variables which create the complex conditions of ERP projects.

The early indications are that there is some support for the proposition that complexity increases the risk of an unsuccessful project, and can threaten an otherwise 'well managed' implementation. This has implications for the way project managers and project teams or departments learn, and how they use the large amount of existing research to help them better manage complex projects.

It is hoped that some practical insights can be gained from the lessons learned from these case studies following a more in depth analysis of the data. This will be validated through a further round of interviews with senior managers, project managers, and academics in the field of project management. From this it is hoped to gain a greater understanding of the project management process in implementing complex information systems.

References:

Bancroft, N., Seip, H. and Sprengel, A. (1998) *"Implementing SAP R/3: how to introduce a large system into a large organization, 2nd Ed, "*, "Greenwich, CT, Manning Publications".

Davenport, T. H., Eccles, R. G. and Prusak, L. (1992) Information politics *Sloan Management Review, Fall v34 n1 p53 (13)*.

Delone, W. H. and Mclean, E. R. (1992) Information Systems Success: the quest for the dependant variable *Information Systems Research, 3, 1, pp 60-95*.

Dvorak, R. E., Holen, E., Mark, D. and W.F, M. I. (1997) Six principles of high performance IT *McKinsey Quarterly,3, pp 164-177*.

Earl, M. J. (1996) *Information management: the organizational dimension,* Oxford University Press.

Eisenhardt, K. M. (1989) Building theories from case study research *Academy of Management Review, 14, 4, pp. 532-550*.

Galliers, R. D. and Baker, B. S. (1994) *Strategic Information Management,* Butterworth Heinemann.

Huber, G. P. and Daft, R. L. (1987) *"The information environments of organizations. in Jablin, F.M., Putnam, L.L., Roberts, K.H. & Porter, L.W. (eds.) Handbook of organizational communication.",* Sage Publications.

Ives, B. and Javenpaa, S. L. (1991) Applications of global information technology: key issues for management *MIS Quarterly, 15,1, pp 33-49*.

Johnson, J. 2000 The Chaos Report. The Standish Group.

Kuzel, A. J. (1992) *"Sampling in qualitative enquiry. In B.F. Crabtree & W.L. Miller (Eds.) Doing qualitative research (pp 31-34) (Research Methods for Primary care Series, Vol. 3). ",* Newbury Park CA. Sage.

Mason, R. and Mitroff, I. (1981) *Challenging Strategic Planning Assumptions,* " Wiley, New York.".

Morris, P. W. G. (1996) *Project management: lessons from IT and non IT projects. In M.J.Earl (Ed.) Information management. The organizational dimension.,* Oxford University Press.

Morris, P. W. G. and Hough, G. H. (1987) *The Anatomy of Major Projects,* "Wiley, Chichester".

Pinto, J. K. (1997) The power of project management *Industry Week, August 18, v246 n15, pp138-141*.

Porter, M. E. (1985) *Competitive Advantage,* "Free Press, New York".

Remenyi, D. (1999) *IT Investment: Making a business Case,* Butterworth Heinemann.

Whyte, G. B., A.;Edwards,C. (1997) Understanding user perceptions of information systems success *Journal of Strategic Information Systems,* **6,** 35-68.

Wilson, D. C. (1992) *A Strategy for Change,* "Routledge, pp 69-91".

Yin, R. K. (1994) *Case study research: design and methods,* "Sage Publications Ltd., London".